REMARKS

This paper is responsive to the Office Action mailed November 18, 2003. Amendment, reexamination and reconsideration of the application is respectfully requested.

The Office Action

In the Office Action mailed November 18, 2003:

The timeliness of the Applicants traversal of the restriction requirement was acknowledged; however, the traversal was found to be not persuasive; and

Claims 4-23 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,680,230 to Kaburagi ("Kaburagi").

The Present Application

For purposes of brief review, the present application is directed to a method and system for rendering single colorant versions of color images while preserving as much information from the color image as possible and minimizing image distortion. For example, the present application is directed to a system and method for rendering black and white versions of color images. Typical color image authoring devices can produce over 16 million different colors, while typical black and white rendering devices can only produce 256 shades of gray. Obviously, a great number of colors must be mapped to each level of gray. Therefore, portions of a color image that are quite obviously different colors can appear to be the same color when the image is rendered in black and white. When the image portions in question are, for example, different sections of a pie chart or bar graph, this loss of information can render the chart or graph useless (page 2, lines 5-12). The system and method of the present application addresses this problem by analyzing an image to find colors in the image that would otherwise be rendered in the same manner and altering the rendering process for one or more of the conflicting colors so that the distinctiveness of those portions of the color image comprised of the colors that conflict in black and white can be preserved in the black and white version of the image. For instance, the rendering process is altered by adding a texture to portions of the black and white version of the image that represent one or more of the conflicting colors (e.g., compare Fig. 1, 122, 126 to Fig. 9, 922, 926). For example, the texture is applied through spatial modulation. Spatial modulation

may be achieved through the application of selected half tone screens. For instance, the black and white version of a first conflicting color may be rendered using a first line screen and the black and white representation of a second conflicting color may be rendered with a different or second lined screen. Subtle imaging artifacts associated with the selected screens (e.g., the striping visible in Fig. 9) restores some of the distinctiveness of the different colors in the original color image that would have otherwise been lost (e.g., Fig. 1, 122, 126). It is to be noted that the texturing or spatial modulation notwithstanding, the lightness of the rendered conflicting colors is not altered. Therefore, the lightness of the colors in the original image is preserved in the rendered black and white version of the image. Furthermore, portions of the black and white image that are not associated with conflicting colors remain unaffected. Therefore, deleterious effects of the process are minimized, thereby allowing the methods of the present application to be applied in a default or "walk-up" mode of an image processor, such as, for example, a photocopier.

The Cited Reference

In contrast, the primary reference of the Office Action to Kaburagi allegedly discloses an image processing method and apparatus wherein, if a full colored original is presented in two colors for output, some areas may appear in the same color. In the case of, for example, the red image data shown in FIG. 16B, it is easily known that magenta and yellow have the same density with the red reference axis as a symmetrical axis. Therefore, the apparatus of Kaburagi solves the problem of such same color presentation by setting the parameters (the reference axis and the range of density spreading), which prevent the same color production (column 13, lines 9-17). Consequently, the density values of these two points (magenta and yellow) are changed. Specifically, as shown in the example of FIG. 17C, magenta is made more dark than yellow by shifting the reference axis (column 13, lines 54-58). It is respectfully submitted that this procedure changes or distorts all the colors (or shades of grey) in the output image. Furthermore, Kaburagi does not disclose or suggest a solution for the case where the input color image includes a plurality of colors that will conflict in the output image or the case where shifting the axis actually creates conflicting colors. For example, if the input image also includes objects that are colored light magenta and dark yellow, which because of their different luminance would not have been conflicting, shifting the axis to darken

magenta and lighten yellow can cause those objects to be rendered at the same density and therefore conflict!

Kaburagi discloses using patterns for some purpose. However, Kaburagi does not disclose or suggest using patterns to maintain the distinctiveness of colors in a color image in a single colorant version of that image. Instead, Kaburagi discloses the same pattern in rendering single colorant versions of colors having the same luminance (e.g., conflicting colors). For example, see FIG. 44 wherein colors having a luminance level ranging from 10H to 20H are assigned x, y, z parameter values of 0, 0, 1 respectively, and FIG. 46, which indicates that colors assigned x, y, z parameter values of 0, 0, 1 are all rendered with a pattern (the one in the upper left hand corner of the figure). Alternatively, see FIG. 47A-FIG. 47D, which indicate that all colors having a luminance level that is assigned the parameter values 0, 0, 1 are rendered as the pattern shown in FIG. 47B.

Furthermore, Kaburagi does not disclose or suggest applying the patterns only to conflicting colors. Instead, as shown in FIG. 44, Kaburagi discloses assigning a set of parameter values to all luminance levels from 00H - FFH (column 30, line 65 - column 31, line 15).

The Applicants note that in this last portion of Kaburagi, the references to the figures are incorrect. For example, it is respectfully submitted that where the specification refers to FIG. 42, it means to refer to FIG. 43, where the specification refers to FIG. 43, it means to refer to FIG. 44 and so on.

Telephone Interviews

The Applicant wishes to thank the Examiner for participating in a Telephone Interview on January 22, 2004. During that Interview the Examiner, Montilewa Good-Johnson, and the Applicant's representative, Thomas Tillander discussed proposed claim amendments and the Kaburagi reference. Mr. Tillander made reference to column 13 of Kaburagi, as discussed above, wherein Kaburagi explains that in the method of Kaburagi when colors having the same "density" are detected, Kaburagi solves the problem of such same color presentation by setting the parameters (the reference axis and the range of density spreading), which prevent the same color production (column 13, lines 9-17). Mr. Tillander submitted that Kaburagi does not disclose or suggest applying spatial modulation to, for example, the magenta and/or yellow portions of an image so that a black and white version of

the image can be made with a minimum of distortion. Instead, Mr. Tillander pointed out, Kaburagi changes the reference axis and the range of density spreading, which has the effect of distorting the luminance of all the color of an image (column 13, lines 53-60).

The reference to column 31 of Kaburagi of the pending Office Action was also discussed. The referenced section is related to the patterns shown in FIG.46. Mr. Tillander submitted that FIG. 44 makes it clear that Kaburagi discloses applying a pattern for every lumance level in an image and **not just to conflicting colors**. Furthermore, Kaburagi discloses applying **the same** pattern to colors having the same luminance (i.e.; conflicting colors) (e.g., FIG.44 shows all colors having a luminance values in the range of 00H to 10H are assigned the pattern associated with (0,0,0) in FIG. 46) **and does not disclose or suggest applying different or distinct patterns to one or more black and white version of one or more conflicting colors**.

Independent claims 4, 10 and 21 were discussed in view of the information described above. Mr. Tillander submitted that in the proposal claim 4 included applying spatial modulation only to black and white versions of one or more conflicting color and not to colors that don't conflict. Similar elements in claims 10 and 21 we also discussed.

The Examiner said she was not able to provide guidance as to the allowability of the proposed amended claims and that she would discuss the case with a colleague and contact Mr. Tillander at a later date.

On or about January 30, Mr. Tillander contacted the Examiner to inquire as to the status of the discussion with the colleague. Nothing of substance was discussed.

On or about February 10, the Examiner contacted Mr. Tillander and said the case would be discussed with the colleague on the following day. The substance of the January 22 Interview was briefly reviewed.

On February 17, the Examiner contacted Mr. Tillander and indicated that she had discussed the case with Joseph Mancuso and that the claims would not be allowed in the proposed form. The Examiner made reference to the phrase --at least one-- that occurred in the proposed amendment to claims 4 several times. Mr. Tillander directed the attention of the Examiner to the phrase --**and only to,** at least one respective single colorant version of a conflicting color-- and reminded the

Examiner that Kaburagi discloses applying patterns to all colors of an image not just conflicting ones and that Kaburagi discloses **applying the same pattern to colors that have the same luminance** (i.e.; conflicting colors) and does not disclose or suggest applying patterns in order to distinguish one conflicting color from another. No agreement was reached.

The Claims are Not Obvious

Claims 4-23 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kaburagi.

In reference to **claim 4,** the Office Action appears to assert that Kaburagi discloses applying spatial modulation to at least one gray scale version of conflicting colors (last 2 lines of page 3 of the Office Action). However, the Office Action provides no support for this assertion. Additionally, the Applicant respectfully disagrees.

As explained above, even if the pattern generation of Kaburagi is considered to be spatial modulation, Kaburagi does not disclose or suggest applying the generated patterns to at least one gray scale version of at least one conflicting color. Instead of applying spatial modulation to gray scale or single colorant versions of conflicting colors, in order to render conflicting portions of an image so that they may be distinguished from one another, Kaburagi discloses applying the same pattern for black and white versions of all colors having the same luminance (column 30, line 65 - line 15, and FIG. 44).

Additionally, **claim 4** has been amended to recite --applying at least one distinct spatial modulation to, and only to, at least one respective single colorant version of at least one of the conflicting colors, thereby insuring that all single colorant versions of colors in the image are visually distinguishable from one another, while minimizing distortions in the rest of the single colorant version of the image--. This amendment is slightly different that the proposed amendment discussed during the Interviews in that it includes the word --distinct-- instead of the word --respective--.

As explained above, even if the converted pattern densities of Kaburagi are considered to be spatial modulations, Kaburagi does not disclose or suggest applying the converted pattern densities only to single colorant versions of conflicting colors. Instead, Kaburagi discloses applying patterns for all luminance

levels or all of the single colorant versions of colors in the input image. Furthermore, Kaburagi does not disclose or suggest applying distinct patterns to one or more conflicting colors. Instead, Kaburagi discloses applying the same pattern to all colors having similar luminance (e.g., colors having luminance in the range of 00H to 10H all are assigned the same pattern.

For the foregoing reasons, **claim 4**, as well as **claims 5-9**, which depend therefrom is unanticipated and is not obvious in light of Kaburagi.

Additionally, **Claim 6** has been amended to recite --applying spatial modulation further comprises associating a unique modulation to each of the single colorant versions of each of the conflicting colors--. In explaining the rejection of **claim 6**, the Office Action asserts that Kaburagi discloses applying any type of pattern to represent the gradation levels and directs the attention of the Applicant to column 31, lines 1-15 in support of the assertion. However, the referenced section merely explains that other patterns than those shown in the figures can be used and that more patterns than the sixteen called for by FIG. 44 can be used. Kaburagi does not disclose or suggest that different or unique patterns should be applied when rendering two different colors having the same luminance (e.g., conflicting colors). Instead, Kaburagi discloses that colors having the same luminance (or even similar luminances) are rendered with the same pattern (FIG. 44).

For the foregoing additional reasons, **claim 6** is unanticipated and unobvious in light of Kaburagi.

Claim 7 has been amended to recite --measuring a colored distance between at least one pixel in the image and at least one conflicting color and applying an attenuated spatial modulation to at least one pixel in the single colorant version of the image, the attenuation ranging from 0 to 100% of a reference modulation, the level of attenuation being a function of the measured color distance--. In explaining the rejection of **claim 7**, the Office Action asserts that Kaburagi discloses a color separation method for determining the separation of the density values for the gradient of the color values separated by an angle of a maximum axis and directs the attention of the Applicants to column 18, lines 5-55.

However, it is respectfully submitted that the Examiner has misunderstood the referenced section. Kaburagi uses the word --separation--, but this is not a reference to measuring a color distance. Because a color image can be separated into cyan, magenta and yellow components, or red, green and blue components or

cyan, magenta, yellow and black components, each of these components is referred to as a separation. It is respectfully submitted that the referenced section merely explains a method Kaburagi uses for determining densities of red and black colorance based on cyan, magenta and yellow colorant densities of an input image during a translation process for rendering a two colorant version (red and black) of the input image. Kaburagi does not disclose or suggest measuring a color distance between at least one pixel in an image and at least one conflicting color. Kaburagi does not disclose or suggest applying an attenuated spatial modulation ranging from 0 to 100% of a reference modulation, nor does Kaburagi disclose or suggest that the level of attenuation be a function of a measured color distance.

For the foregoing additional reasons, **claims 7**, as well **claims 8 and 9**, which depend therefrom, is unanticipated and is not obvious in light of Kaburagi.

Claim 8 recites --the level of attenuation being a non-linear function of the measured color distance--. In explaining the rejection of **claim 8**, the Office Action asserts that Kaburagi discloses the patterns generated and selected to meet the luminance signal for the density and area to be outputted and directs the attention of the Applicants to column 31, lines 21-41.

It is respectfully submitted that the quality of the translation or writing of Kaburagi is such that is very difficult to know what column 31, lines 21-41 mean. However, it is respectfully submitted that the referenced section does not disclose or suggest that a spatial modulation be applied to at least one pixel in a single colorant version of an image or that the level of attenuation be a non-linear function of a measured color distance between the color of a pixel and a conflicting color.

For the foregoing additional reasons, **claim 8** is unanticipated and is not obvious in light of Kaburagi.

Claim 9 recites --the level of attenuation being a linear function of the measured color distance--.

In explaining the rejection of **claim 9**, the Office Action stipulates that Kaburagi fails to disclose applying an attenuated spatial modulation to at least one pixel ranging from 0 to 100% of a reference modulation. As explained above, the Applicants respectfully agree. However, the Office Action goes on to assert that Kaburagi discloses applying a pattern to the density of an area based on the gradation values and the values set to meet the luminance signal level and implies that therefore, "it would have been obvious to one of ordinary skill in the art at the

time of the invention that the attenuated spatial modulation is consistent with the pattern being applied in Kaburagi and that the gradation represents a gray scale version, and to include a range to meet the luminance signal level of the gradation values." However, the connection between the attenuation of a reference modulation being a linear function of a measured color distance and the alleged disclosure of Kaburagi of applying a pattern to density area based on the gradation values and the values set to meet the luminance signal level is unclear to the Applicant. Clarification is respectfully requested.

Furthermore, the relationship between the obviousness to one of ordinary skill in the art at the time of the invention that the attenuated spatial modulation is consistent with the pattern being applied in Kaburagi and that gradation represents a gray scale version, and to include a range to meet luminance signal level of the gradation values to the allowability of **claim 9** of the present application is also unclear. Clarification is again respectfully requested.

In any event, it is respectfully submitted that Kaburagi does not disclose or suggest applying an attenuated spatial modulation to at least one pixel in an image, the attenuation ranging from 0 to 100% of a reference modulation, the level of attenuation being a linear function of the measured color distance.

For the foregoing additional reasons, **claim 9** is unanticipated and is not obvious in light of Kaburagi.

Claim 10 has been amended to recite --a gray scale modulator operative to add spatial modulations to single colorant versions of only the conflicting colors of within the single colorant version of the color image--. In explaining the rejection of **claim 10**, the Office Action stipulates that Kaburagi fails to disclose a gray scale modulator. The Office Action then goes on to assert that Kaburagi discloses applying a pattern to the density of an area based on the gradation values and the values set to meet the luminance level. It is respectfully submitted that even if the assertion of the Office Action is correct, such disclosure is unrelated to adding spatial modulations to single colorant versions of only the conflicting colors within a single colorant version of a color image. As explained above, Kaburagi does not disclose or suggest applying modulations (or patterns) to only single colorant versions of conflicting colors. Kaburagi discloses applying patterns for all luminance levels without regard to whether or not the luminance levels are associated with conflicting colors. Furthermore, Kaburagi discloses applying the same pattern when

luminance levels are the same, or even when luminance levels are merely similar (FIG. 44).

For the foregoing reasons, **claim 10**, as well as **claims 11-20**, which depend therefrom, is unanticipated and unobvious in light of Kaburagi.

Claim 13 recites --a color relationship discriminator operative to receive conflicting color classification information from the image analyzer and color image pixel information, the color relationship discriminator operative to determine a relationship between the color image pixel and the conflicting color--. In explaining the rejection of **claim 13**, the Office Action again refers to column 18, lines 5-55 for their disclosure of a color separation method. However, as explained above, in reference to **claim 7**, the disclosure at column 18, lines 5-55 is related to transforming pixels in a CMY based color space (cyan, magenta and yellow) into pixels of an R and K color space (red and black). The referenced section is unrelated to measuring distances between conflicting colors and Kaburagi does not disclose or suggest a color relationship discriminator operative to receive conflicting color classification information from an image analyzer and color image pixel information and to determine a relationship between the color image pixel and the conflicting color.

For the foregoing additional reasons, **claim 13**, as well as **claims 14-18**, which depend therefrom, is unanticipated and is not obvious in light of Kaburagi.

In explaining the rejection of **claim 14**, the Office Action stipulates that Kaburagi fails to disclose a modulation attenuator. Nevertheless, the Office Action asserts it would have been obvious to one of ordinary skill in the art at the time of the invention "that the attenuated spatial modulation is consistent with the pattern being applied in Kaburagi and that gradation represents a gray scale version and to include a modulation attenuator to meet the luminance signal level of the gradation values". The Applicant respectfully disagrees. Kaburagi does not disclose or suggest determining a relationship between a color image pixel and a conflicting color. Nor does Kaburagi disclose or suggest modulating a pattern.

Furthermore, Kaburagi does not disclose or suggest modulating a pattern based on a relationship between a color image pixel and a conflicting color. It is respectfully submitted that the only motivation to modulate a pattern is found in the present application and the rejection of **claim 14** is based on impermissible hind sight.

For the foregoing additional reasons, **claim 14** is unanticipated and is not obvious in light of Kaburagi.

Similar arguments to those presented in support of **claim 14** are submitted in support of **claim 15**. Kaburagi does not disclose or suggest a modulation generator operative to generate a gray scale modulation for application to a gray scale version of a color. Kaburagi simply assigns patterns to ranges of luminance values without regard to whether an image includes conflicting colors. Furthermore, it is respectfully submitted that at the point that Kaburagi assigns patterns to luminance levels. Kaburagi assumes there are no conflicting colors because Kaburagi alters the luminance levels of all the colors in an image in order to avoid conflicting colors (column 13, lines 9-18, column 13, lines 53-60).

For the foregoing additional reasons, **claim 15** is unanticipated and is not obvious in light of Kaburagi.

Claim 16 recites --the relationship between the conflicting color and the color image is a color distance within a color space--. In explaining the rejection of **claim 16**, the Office Action again refers to column 18, lines 5-55. Arguments similar to those submitted in support of **claim 7** are submitted in support of **claim 16**.

For the foregoing additional reasons, **claim 16** is unanticipated and is not obvious in light of Kaburagi.

Claim 17 recites --wherein the relationship between the conflicting color and the color image pixel comprises a color distance within a perceptually uniform color space--. In explaining the rejection of **claim 17**, the Office Action asserts that Kaburagi discloses a two separation color unit and directs the attention of the Applicant to column 9, lines 29-39. It is respectfully submitted that disclosure of a two color separation unit is completely unrelated to measuring a distance between a conflicting color and a color image pixel in a perceptually uniform color space. The referenced section includes the phrase --non-linearity--. However, the non-linearities-- being corrected are non-linearities of the sensitivity to exposure of the CCD image sensor 3701 of an image processing system of Kaburagi.

For the foregoing reasons, **claim 17** is unanticipated and unobvious in light of Kaburagi.

Arguments similar to those submitted in support of **claim 17** are submitted in support of **claim 18**. Kaburagi simply does not disclose or suggest determining a relationship between a conflicting color and a color image pixel is a color distance

within a CIELAB color space.

For the foregoing additional reasons, **claim 18** is unanticipated and is not obvious in light of Kaburagi.

Claims 21, 22 and **23** were rejected based upon similar rational as **claim 4** and **claims 5** and **6** respectively. Arguments similar to those submitted in support of **claims 4, 5** and **6** are submitted in support of **claims 21-23**. Kaburagi does not disclose or suggest selectively spatially modulating a portion of a single colorant version of an image that is associated with a conflicting color.

For the foregoing reasons, **claim 21**, as well as **claims 22** and **23**, which depend therefrom, is unanticipated and is not obvious in light of Kaburagi.

TELEPHONE INTERVIEW

In the interests of advancing this application to issue and compact prosecution, the Applicants respectfully request that the Examiner telephone the undersigned to discuss any of the foregoing with which there may be some controversy or confusion or to make any suggestions that the Examiner may have to place the case in condition for allowance.

CONCLUSION

Claims 1-3 stand withdrawn with traverse. **Claims 4-23** remain in the application. For the foregoing reasons, the case is in condition for allowance. Accordingly, indication thereof is respectfully requested.

In the event the Examiner considers personal contact advantageous to the disposition of this case, he/she is hereby authorized to call Joseph D. Dreher, at the Telephone Number (216) 861-5582.

Respectfully submitted,

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